PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Method of Re-arranging Rod-like Articles

I, KURT KÖRBER, a German citizen, of 10 Am Pfingstberg, Hamburg-Bergedorf, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a method of re-arranging rod-like articles, and is particularly concerned with the manipulation of filter plugs of a length each suitable for assembly with cigarettes or the like (hereinafter called the "final length"), which plugs are produced from a row of filter rods each of n times the final length lying transversely to the direction of feed and spaced one from the other by nt, where t is the intended pitch of the filter plugs, by causing them to move in a path and cutting them into n rows of portions of equal length, whereupon one of the rows of rod portions is carried onward without change of the feed speed thereof, and the other rows of rod portions are displaced relatively in such a manner that after they have been shifted axially they form a single row in line ahead formation at pitch t.

Various methods and apparatus have been proposed for re-arranging or staggering filter rod portions or plugs cut from filter rods having a multiple of the final length.

One method proposed in Specification No. 865,624 consists in placing filter rods having n times the length of the rod portions into every nth groove of a continuously rotating magazine drum, for cutting during the movement thereon into n rod portions, one of the rows of rod portions formed thereby being moved onward while remaining in the feed plane thereof separately from the other rows of rod portions, whereas the rod portions of the other rows are removed from the first row of rod portions remaining in its transport plane and are displaced successively into the feed plane of this first row and are transferred successively after successive rotations of the conveyor means into empty grooves following the rod portions of the first said row.

In accordance with Specification No. 963,201 rod portions supplied at equal speeds and lying co-axially adjacent one another are handled in such manner that, as related to one of the rows of rod portions at the edge, the respectively adjacent double plugs are moved along a longer path, however always with a constant speed, so that after these paths of different lengths have been traversed the rod portions which originally lay co-axially next to each other, lie behind each other in the direction of rotation and are then converted in known manner by axial displacement into a single row moving transversely to the axis of the rod portions.

It is an object of the present invention to stagger the rod portions in a relatively short conveyance path. According to the method of the invention the rod portions of the n-1 rows to be staggered are moved relatively to a conveying surface supporting them and movable at the same speed.

In a preferred embodiment of the method according to the invention provision is made that the rod portions are caused to roll for effecting the movement relatively to the supporting face carrying them

In order to prevent the rod portions from making an undesired movement relatively to the supporting face carrying them, a further embodiment of the method according to the invention provides that the rod portions of the rows to be staggered are held fixed in the two end positions, preferably by suction. Instead of the suction or even additionally there-

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to another embodiment of the invention provides that the rods portions of the rows to be staggered are held fixed mechanically. Mechanical fixing is of particular importance when the rods are cut on the supporting face on which they are subsequently rolled and staggered.

One arrangement for carrying out the method according to the invention has a conveyor in which the receiving means for the rows of rod portions to be staggered have a pitch nt, and in which the receiving means for one of the rows of rod portions have a pitch t, whereas the other rows of rod portions rest on surfaces of the conveyor, and the lateral walls of the receiving means for the rod portions to be staggered limit the movement of the rod portions relatively to the said surfaces

The other rows of rod portions to be staggered are engaged by receiving means which are movable, in particular pivotally, and may be provided with a controllably movable lateral wall lagging in the direction of staggering, and may be constructed in the form of forks.

In a further embodiment of the arrangement the receiving means for the rod portions to be staggered are rigidly connected to the conveyor and have a width such that one of the side walls thereof lies in one line with the associated terminal wall of one of the receiving means for the one row of rod portions, and the other terminal walls thereof are in line with the respective side wall of one of the adjacent or successive receiving means.

If the rod portions are to be staggered by a rolling action, rolling means are associated with their receiving means and the periphery of such means is dimensioned so that they roll the rod portions from the one terminal wall of the receiving means to the other.

In a further embodiment of the arrangement according to the invention retaining means are associated with the relatively wide receiving means, to hold the rod portions in both end positions in contact with the terminal walls. In one embodiment of the invention suction ducts in the side walls are used as the retaining means. Another embodiment provides that the retaining means are controllably movable stops disposed on the conveyor which form narrow receiving means with the associated walls of the receiving means for the rod portions to be staggered.

In one arrangement having a conveyor for supplying rods and rotating cutting means associated with this conveyor for cutting the rods into rod portions, the invention provides that the holding means are constructed as rotating discs which are associated with the cutting means for cutting the rods.

In one embodiment of this nature having one or more cutters for cutting the rods the clamp discs of the cutters have groove-like recesses of pitch t which engage and co-operate with the rods.

In the embodiment of the invention in which the rod portions are rolled the arrangement is characterised in that the rolling means associated with the receiving means for the rod portions to be staggered comprise small rollers.

In one particular embodiment of these rollers in which the drive shafts of the rollers are axially aligned, these rollers are of the same diameter, and the effective rolling surface is limited by recesses in the surface of the rollers.

In another embodiment of the arrangement according to the invention, instead of using rollers stationary rolling faces are associated with the receiving means for the rod portions to be staggered, in which case the rolling faces may be preceded by an acceleration roller.

Several embodiments for carrying out the method according to the invention are illustrated by way of example in the accompanying drawings in which:—

Fig. 1 is a diagrammatic illustration of a filter cigarette assembly machine in side view;

Fig. 2 is a perspective partial view on an enlarged scale of a re-arranging drum according to the one embodiment, having forks for moving the rod portions to be staggered;

Fig. 3 is a partial cross-section through the drum according to Fig. 2, in section;

Fig. 4 is a perspective partial view of the drum according to a second embodiment having rolls for moving the rod portions to be rearranged, also on an enlarged scale;

Fig. 5 is a third embodiment showing a partial view of the drum according to Fig. 4, but with stationary rolling faces;

Fig. 6 is a perspective partial view of the drum according to Fig. 5 with an acceleration roll preceding the stationary rolling face, and

Fig. 7 is a fourth embodiment showing a perspective partial view of the drum according to Fig. 4 in which the receiving means for the rod portions to be shifted are movable upwards and downwards.

In Fig. 1 a magazine 1 contains filter rods S which are received by a magazine drum 2 and fed to a cutting and re-arranging device consisting of drum 3 on which the filter rods S are cut by means of cutters 4 and 5 into, for example, three rod portions F which may be filter plugs of a length suitable for assembly between pairs of cigarettes, and are rearranged to form one row of plugs F in line ahead. By way of an intermediate drum 6 the cigarettes are deposited in pairs on an assembly drum 7 in such manner that the rod portions F arriving from the cutting and shifter drum 3 lie between two cigarettes.

A paper strip is guided through a gumming device 18 from a reel 8 to a cutting drum 10

on which by means of a cutter 9 connector sheets of required length are cut from the paper strip.

As the groups coming from the assembly drum 7 are guided past a presser drum 11 the connector sheets are attached to the groups and delivered in this state, together with the groups to the wrapper drum 12 on which the groups consisting of two cigarettes and an interposed rod portion F are wrapped to form a unit and transferred to a checking drum 13. Subsequent transfer to a cutting drum 14 leads to severing the groups centrally of the plugs by means of a cutter 15. One row of the finished cigarettes are inverted by turning drum 16 to align the head ends of all cigarettes and then transferred to a delivery belt 17.

The cutting and re-arranging device according to the invention is constructed as follows: The drum 3 (which rotates clockwise in Fig. 2) is provided, as shown in Figs. 2 and 3, with receiving grooves 20 in the centre portion 19 on the surface thereof, the centre portion being limited laterally by two slots 21 and 22 into which project the cutters 4 and 5 for cutting the filter rods S to form rod portions F, only the cutter 5 being visible in Fig. 2. A further slot 23 extends in the centre of the centre portion 19 and serves for inserting a lifter under the rod portions F after the same have been re-arranged to form one row.

On both sides of the centre portion 19 (Fig. 2) forks 24 and 25 are provided, which during the transfer from the magazine 1 of the filter rods S having a multiple of the final length (Fig. 1) are in line with the grooves 20 of the centre portion of the drum 3 (see arrows A and B). The side walls 26 and 27 of the forks 24 and 25 also guide the rod portions displaced while resting on surface parts of the drum 3. The forks 24 and 25 thus form receiving means and are located at one end of intermediately pivoted levers 28 which are pivoted on spindles 29 on each side of the drum 3. Rollers 30 are provided at the opposite ends of levers 28 to the forks 24 and 25, and these rollers run on cams 31 which impart a pivotal movement to the forks 24 and 25. During this pivotal movement, and altogether during the whole re-arranging process, the rod portions F are held in their respective receiving means by guides 32, 33 and 34.

Lateral shifting of the rod portions F lying in the forks 24 and 25 on both sides of the rod portions F located in the grooves 20 is effected by means of stationary shifter members 35 (see also Fig. 4) which are disposed above the forks 24 and 25 an engage the ends of the rod portions F standing above the forks 24, 25. The effective range of these shifter members 35 extends from the end faces of the rod portions F lying on the two outer paths of the drum 3 in the transfer position thereof from the magazine, as far as the centre portion 19 of the drum 3.

The operation of this arrangement is as follows: During the transfer from the magazine drum 2 (Fig. 1) the filter rods S are inserted into the receiving means of the drum 3 consisting of the three in-line parts (forks 24 and 25 and grooves 20). A rod portion F lies in each of these parts after the filter rods S have been cut by the cutters 4 and 5. As three rod portions F are cut from each filter rod, the number of central grooves 20 is three times as large as the number of forks 24 and 25. After the filter rods have been cut into rod portions F the forks 24 and 25 on both sides of the drum 3 are moved in such manner that the opposite forks 24 and 25 pivot in opposite directions and uniformly away from the respective groove 20 to effect the transfer of the respective filter rod to a point in line with the empty groove 20 which lies in front or behind, respectively, the groove still carrying the central rod portion. The forks 24 and 25 remain in this position so that when they pass the shifter members 35 the effective edges thereof engage the end faces of the rod portions F projecting over the forks 24 and 25, and push them out of the forks 24 and 25 into the empty grooves 20.

A second embodiment for carrying out the method according to the invention is illustrated in Fig. 4. In place of the forks for receiving the two rod portions F lying outside the central grooves 20, other means 36 and 41 are fixedly disposed on the surface of the drum 3 on both sides of the central grooves 20. Whereas, however, the configuration of the centre portion 19 of the drum 3 with its grooves 20 and the slot 23 corresponds to that according to Fig. 2 the receiving means 36 and 41 are longer than the grooves 20.

The bottoms of the receiving means 36 extend beyond the range of two adjacent grooves 20 of the centre portion, the leading walls 37 as well as the trailing walls 38 lying in line with the corresponding walls of the grooves 20 in the centre portion 19. In contrast the bottoms of the receiving means 41 extend over the range of three grooves 20 of the centre portion 19 of the drum 3 and correspond otherwise to the receiving means 36. This drum also is associated with shifter members 35 as in the preceding example which extend from the outer edge of the drum surface to the centre portion. The rod portions F are held in the receiving means 36, 20 and 41 of the drum 3 by means of suction applied through suction apertures 42 in the receiving means, the connection of these suction apertures 42 to a suction chamber being effected by way of suction ducts in a known manner. The circular cutters 4 and 5 engag-

ing the slots 21 and 22 are driven separately by a shaft 43 and a hollow shaft 44. Both cutters 4 and 5 are associated with, for example, disc-like holding members 45 and 46 which hold the filter rods S just before, during and after the cutting operation by means of recesses 47 and 48. The holding member 45 is driven by a hollow shaft 49 and the holding member 46 is driven by a shaft 50.

The receiving means 36, 20 and 41 pass below a shaft 51 during the rotation of the drum. To this shaft 51 rolling members 52, 53 are attached, on which having depressed surface areas 54 and 56, respectively, so that only the remaining surface portion 55 extending over 120° and surface portion 57 extending over 240° of the rolling members 52 and 53, respectively, are operative and are driven at the same circumferential speed as the drum 3, but in the opposite direction. The developed length of the effective circumferential surface of the rolling members is equal to the length of the bottoms of the respective receiving means 36 and 41, respectively. No rolling member is provided for the grooves 20.

This arrangement operates as follows: During the movement of the drum 3 the filter rods S received from the magazine drum 2 pass under the cutters 4 and 5, the discs 45 and 46 with their recesses 47 and 48, respectively, extending over and engaging the filter rod to be cut and holding it on its support. The difference of rotary movement between the cutters 4 and 5 and the holding members 45 and 46, which movement in the latter case corresponds to the speed of the drum 3, is achieved by independent drives for these parts. After cutting, the rod portions F rest against the respective leading walls 37 and 40 of the receiving means 36 and 41 and arrive in the further course of the drum movement under the rolling members 52 and 53. These rotate at the same speeds, but have different effective surface portions 55 and 57, respectively, corresponding to the length of the receiving means lying thereunder, so that the rod portions F are caused to roll backwards from one wall 37 or 40 to the other wall 38 or 39, respectively, of the receiving means 36 or 41, respectively, when the rod portions F pass under the rolling means 52, 53. Both the rod portions F thus lie in line with empty grooves 20 of the centre portion 19, and are later pushed by the guide members 35 during the further movement into the empty grooves 20 so that one row in line ahead of successive rod portions F is formed.

A third embodiment of the rolling means is illustrated in Fig. 5. In this case the end rod portions F are guided under a stationary member 58 which imparts a rolling motion to the portions F. In order to ensure perfect transfer of the rod portions F from the lateral receiving means in the respective central groove 20, strip-shaped members 73 and 74 are provided in the bottom of each receiving means and are movable upwardly and downwardly in a manner similar to that to be described with reference to Fig. 7. These members 73 and 74 serve to hold the rod portions during cutting but are lowered when rolling takes place. As shown in Fig. 6 each receiving means for example 36 may be preceded by a rotating roller 61 by which the rod portions F are set in rotary motion without being rolled into the end position. As the drum 3 rotates the rod portion F is guided smoothly under the stationary rolling face 60 and rolling of the rod portion occurs thereby.

The drum 3 in the fourth embodiment of Fig. 7 has also the same centre portion 19 with grooves 20 and peripheral channels 21, 22 and 23. The lateral receiving means 36 and 41 located on either side of the grooves 20 are also provided with suction apertures 42. The ratio of the lengths of the lateral receiving means 36 and 41 correspond to the example according to Fig. 4. The base members 62, 63 of lateral receiving means 36 and 41 are movable upwardly and downwardly, the leading and trailing end faces thereof, considered in the direction of rotation, serving (when in the up position) to hold the rod portions located in the lateral receiving means. Below the level of the receiving means guide faces 70 and 71 are provided which are joined to the ends of arms 64 and 65, the other ends of which are connected to the base members 62 and 63. These guide faces 70 and 71 are resiliently mounted in drum walls 68 and 69, respectively, by means of springs 72. The springs 72 tend to press the base members upwardly by means of the guide faces 70 and 71 which are connected to the arms 64 and 65. As the guide faces 70 and 71 pass beneath rollers 66 and 67 mounted on fixed spindles the guide faces 70 and 71 are depressed, moving the arms 64 and 65 downwardly and thus depressing the base members 62 and 63 so that the rod portions F lying on each side of the centre portion are free to move over the base members 62 and 63 by the action of a member 58 (see Fig. 5) until they reach the end walls 76, 78 respectively at which point they are held by suction ready for subsequent insertion into vacant grooves 20.

As the guide faces 70 and 71 move away from the rollers 66 and 67 the base members 62 and 63 move to their uppermost positions and form, in conjunction with the ends walls 75 and 76 or 77 and 78 respectively, guides for the rod portions F to enable them to be pushed into the vacant grooves 20.

WHAT I CLAIM IS:—

1. Method for re-arranging rod portions produced from filter rods or other rod-like articles while they are being conveyed, in

which the rods lie parallel to each other in a row and disposed transversely to the direction of conveyance at a pitch spacing of n times the required pitch spacing of the rod portions and move in a path in which they are each successively cut into n rod portions to form n parallel rows of rod portions and thereafter one of the said rows of rod portions is conveyed forward without change of the feed speed thereof and the other portions are supported upon respective conveying surfaces and receive an additional displacement in the conveyance direction upon said respective surfaces, whereafter each said other portion is moved axially so that all the rod portions are re-arranged to form, from said n parallel rows, a single row in line ahead spaced at the said required pitch spacing.

2. Method according to claim 1, characterised in that the shifting of at least one of the other rows occurs in opposition to the direction of conveyance.

3. Method according to claim 1, characterised in that the shifting of one of said other rows is in the direction of feed and against the direction of feed for another of said other rows.

4. Method according to any of claims 1 to 3, characterised in that the rod portions are caused to move by gravity so as to effect a movement relatively to the supporting face carrying same.

5. Method according to any of claims 1 to 3, characterised in that the rod portions are moved with a throwing action for carrying out the relative movement.

6. Method according to any of claims 1 to 3, characterised in that the rod portions are caused to roll in order to carry out the relative movement.

7. Method according to any of claims 1 to 6, characterised in that the movement of rod portions of the said other rows is determined and limited in two end positions.

8. Method according to any of claims 1 to 7, characterised in that the rod porions of the said other rows are held by means of suction.

9. Method according to claim 7, characterised in that the rod portions of the said other rows are held mechanically.

10. Device for carrying out the method according to any of claims 1 to 9, having a conveyor which carries surfaces which receive a plurality of rows of parallel spaced rod portions which are to be re-arranged or shuffled so as to form a single row of such portions in line ahead, in which one surface comprises receiving means for one row having a pitch spacing which is the same as the required pitch pacing of the rod portions, while the other surfaces support the rod portions of the other rows at a multiple of the required pitch spacing, and means are provided to displace each rod portion of said other rows upon the said surfaces relatively to the rod portions of said one row and in the feed direction thereof until the rod portions carried by the several rows are mutually spaced as seen in the axial direction, and means being provided for displacing the rod portions carried by said other rows axially to form the single row of rod portions in line ahead at the said required pitch.

11. Device according to claim 10, wherein the rod portions of the said other rows are engaged by receiving means, and the base of each such means is formed by a surface of the conveyor and the terminal walls are arranged to limit the displacement of the rod portions in the direction of feed.

12. Device according to claim 11, characterised in that the terminal walls of the receiving means for the rod portions to be displaced are provided by forked members which displace the rod portions over the respective conveyor surfaces.

13. Device according to claim 11, characterised in that the receiving means for the rod portions to be shifted are provided by surface sections of a conveyor and have a length such that one terminal wall thereof is in line with the associated terminal wall of one of the receiving means for the said said one row of rod portions, and the other wall thereof is in line with the associated wall of one of the respective preceding or following receiving means.

14. Device according to claim 11, characterised in that rolling members are associated with the receiving means for the rod portions to be shifted, the circumeference of which members is dimensioned so that the members, roll the rod portions from the one wall of the receiving means to the other.

15. Device according to claim 11 or 12, characterised in that retaining means are associated with the receiving means which hold each rod portion in one or the other end positions in contact with the said wall of its respective receiving means.

16. Device according to claim 15, characterised in that suction ducts are arranged as retaining means in the walls of the receiving means for the rod portions to be shifted.

17. Device according to claims 13 or 14, characterised in that controllably movable stops are arranged on the conveyor which together with the associated walls of the receiving means form narrow holders for the portions to be shifted.

18. Device according to claims 10 and 16 which also includes a conveyor for supplying rods and rotary cutting means associated with this conveyor for cutting the rods into rod portions, characterised in that holding means for the rods comprise discs which are capable of rotating and which are associated with means for cutting the rods to produce rod portions.

19. Device according to claim 18 having one or more cutter discs for cutting the rods, characterised in that the discs have associated groove-like recesses which engage the rods before, during and after cutting.

20. Device according to any of claims 10 to 19, characterised in that rolling means are associated with the receiving means for the rod portions to be shifted, said rolling means consisting of a roller-like member.

21. Device according to claim 20, characterised in that the effective rolling face of the said member is limited by recesses in the surface thereof.

22. Device according to any of claims 10 to 21, characterised in that rolling means associated with the receiving means for the rod portions to be shifted consist of stationary rolling faces.

23. Device according to claim 22, characterised in that the stationary rolling faces are preceded by acceleration rolls.

24. A method of re-arranging rod portions substantially as herein described and illustrated.

25. A device for re-arranging rod portions substantially as herein described and illustrated.

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Fig. 1

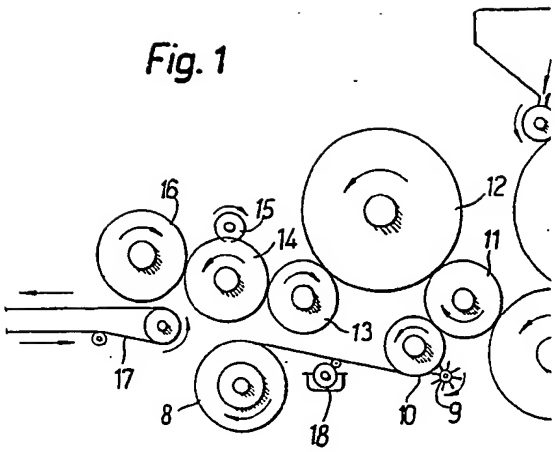
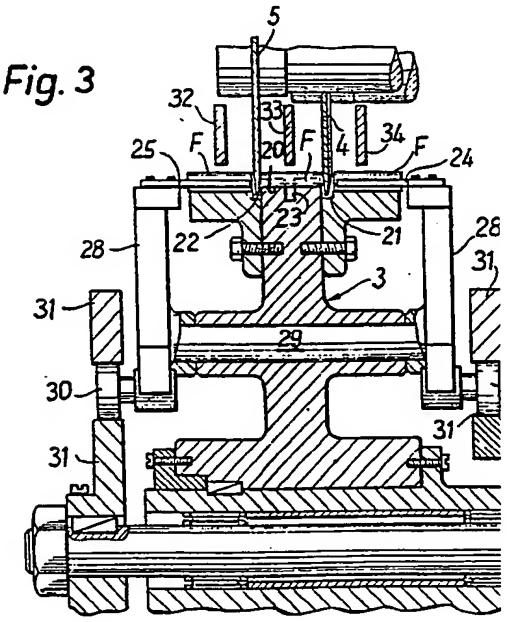


Fig. 3



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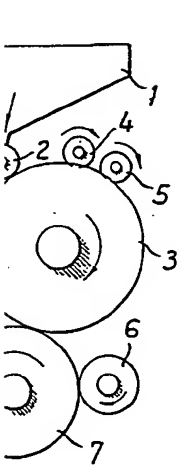

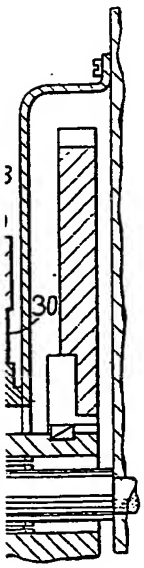

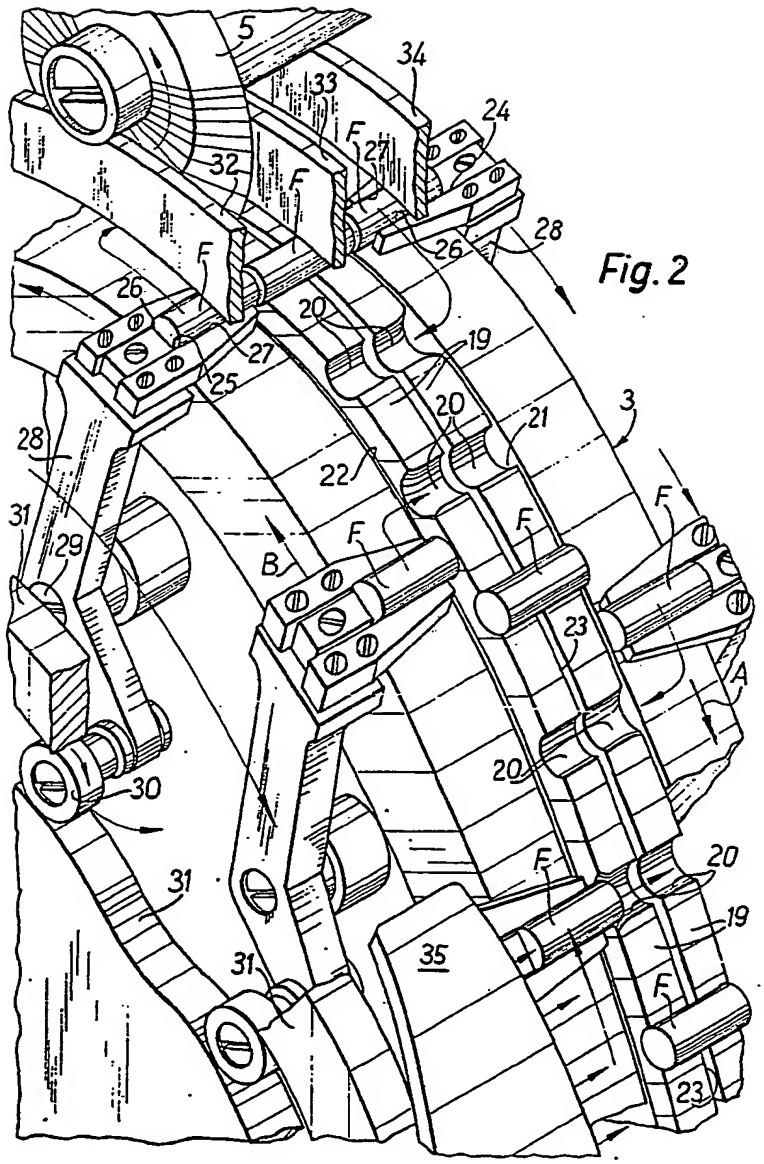

Fig. 2

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Fig. 1

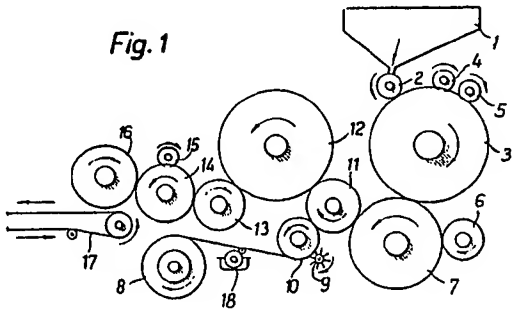


Fig. 3

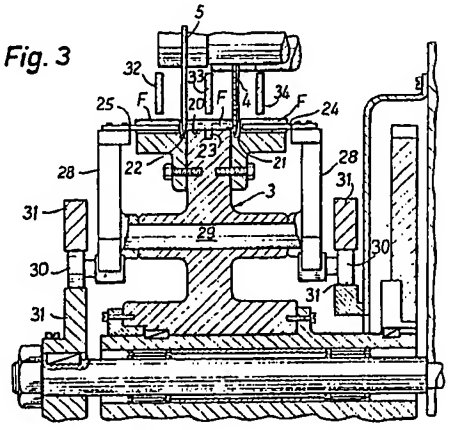
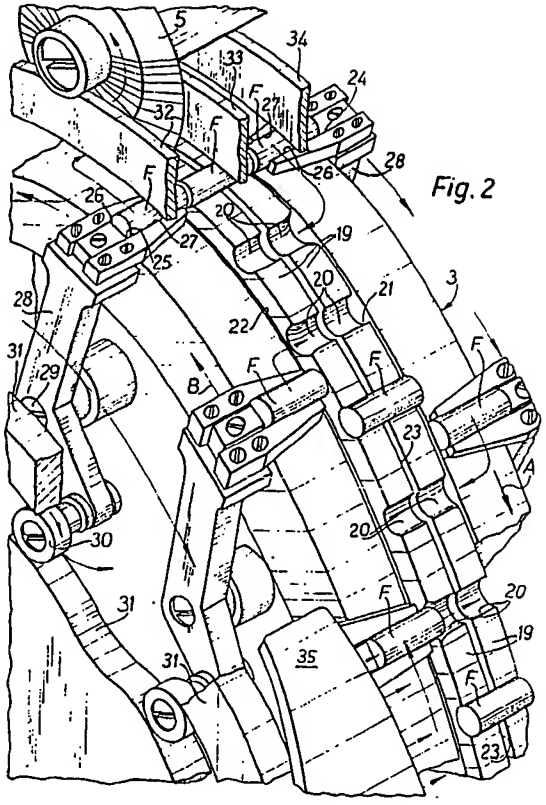


Fig. 2



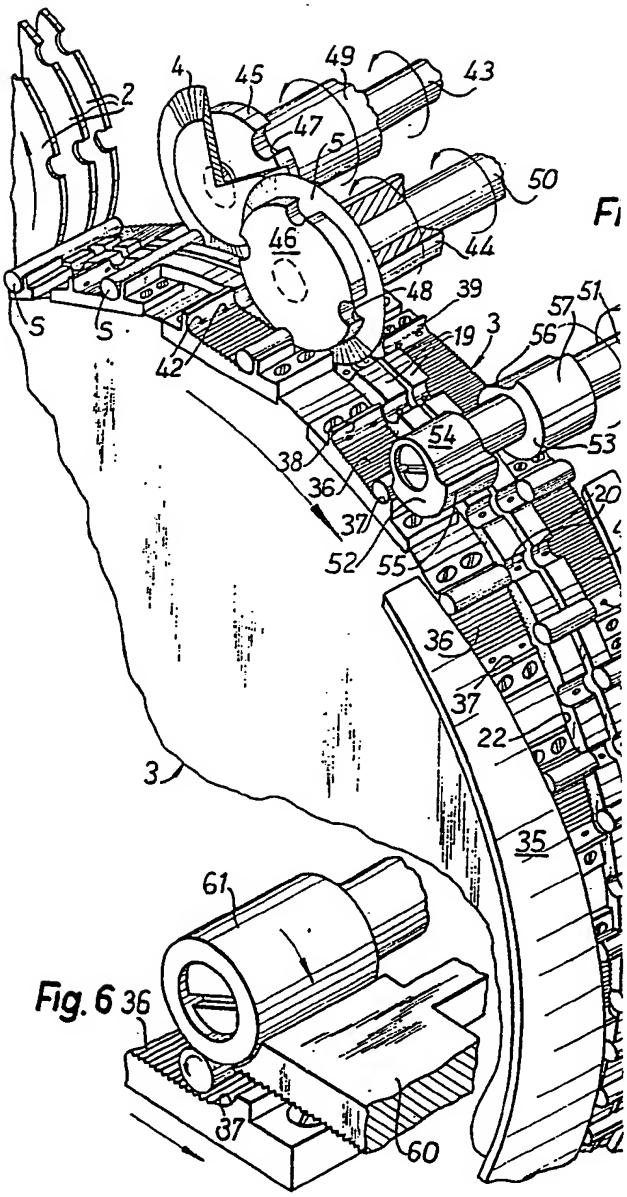


Fig. 6

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Fig. 4

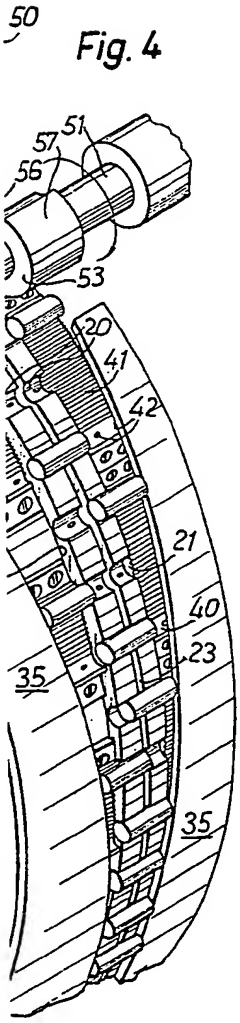

Fig. 5

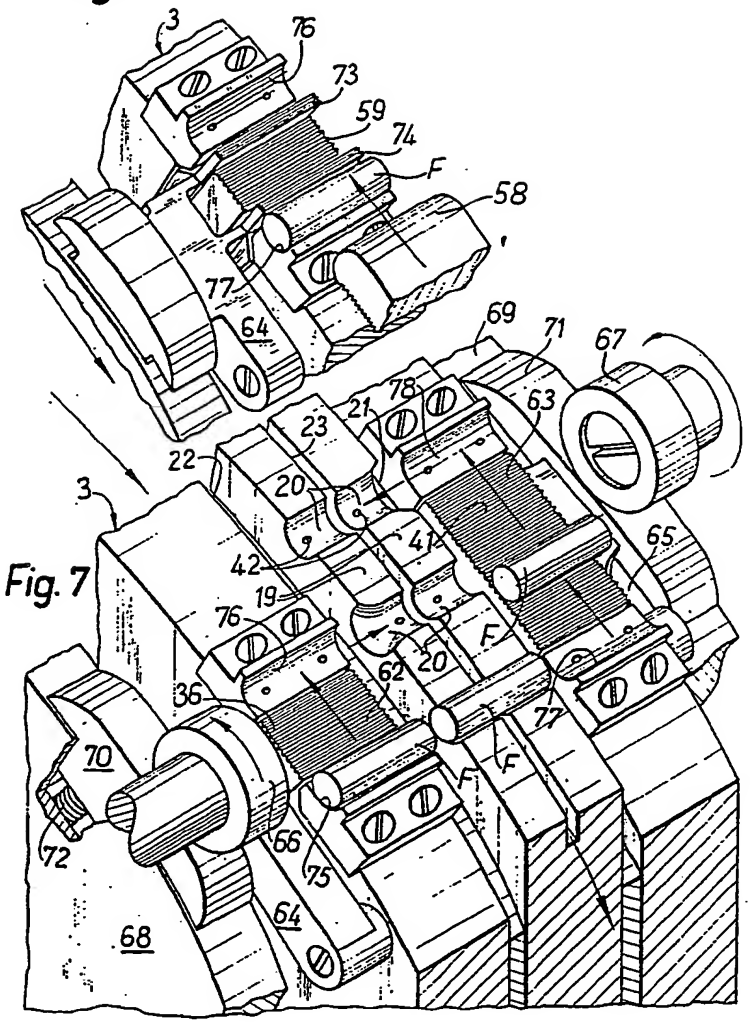

Fig. 7

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